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SCIENCE IN THE U.S.S.R.

SOVIET BIOLOGY[1]

By Dr. L. C. DUNN
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AT the time of the tenth anniversary of the October Revolution in 1927, I was in Moscow; I awakened each morning in the little glass-sided cupola on top of the palatial and elegant mansion which had now become the Institute of Experimental Biology. My first impression was one of familiarity, of at-homeness, for this was a genetics laboratory, filled with the sights and smells associated with the little fly, Drosophila, which breeds in its thousands in the milk bottles of fermenting food which line all the genetics laboratories in the world. But in the farther distance, through the windows, were the spires of Moscow, and these and the physical world they represented were utterly strange and new to me.

This alternation of strangeness and familiarity must have struck many American visitors to Russia, and it persists when we try to examine the scientific achievements of the Soviet Union or indeed of any country not our own. For any modern science is in some sense the same wherever we find it, a part of one interconnected whole resting on common basic principles, with a common past and a common future, and it is artificial and deceptive to try to break it into separate national entities. And yet, just as the history of science consists in part of the achievements of individuals, so also it rests on the contributions of groups of persons with common purposes and common methods, and oftentimes the character of these groups is determined by the physical, economic and social milieu. It was unquestionable that the society behind Soviet biology was very different from that found in Europe and America, and this, together with the temperament, traditions and outlook of the Soviet scien-

[1] Address at the Science Panel of the Congress Celebrating the Tenth Anniversary of American-Soviet Friendship, New York, November 7, 1943. The complete proceedings of the Science Congress including the Medical Session will be published at a later date by the National Council of American-Soviet Friendship.

tists lent a distinctly Russian flavor to their joint work. There was too a kind of revolutionary tinge about their manner of approach to some of the problems of biology. Whereas Westerners were inclined to go in through the traditional front door, our Soviet colleagues seemed at times to break in through the back door or even to come up through the floor.

Thus it comes about that it is possible to speak of "Soviet" biological research and to single out for comment a few of its characteristics. I should like it understood that I do this from a very limited knowledge of Soviet biology which covers a vast field and that I can speak with confidence only about work which is closely related to my own field.

The qualities in Soviet biological research which have struck me most are first, from the purely scientific side, its vitality and activity, and the atmosphere of eagerness, modernity and novelty which has surrounded it. To the outsider looking in it has had aspects of youth and originality which have never attached, for example, to the scientific renaissance which was taking place at about the same time in Japan. In the second place, one Westerner at least has noted the peculiar and almost paradoxical combination of philosophical and theoretical impetus with which practical purposes are pursued. On the organizational side, the peculiarity of Soviet biology is of course that it is centrally planned and administered, chiefly through the Academy of Sciences, that its purpose is not only to discover new knowledge but to penetrate the whole life of the community. It is thus of very great scope both with regard to the numbers of persons engaged in it and in its institutional and geographic connections.

The great vitality of Soviet biology is nowhere better evidenced than in my own field of genetics and its close relative, cytology. Here there is no doubt that the most important contributions have been coming from the U. S. A. and U.S.S.R., and in the number of workers, of institutes and in quality of work these two countries are comparable. Genetics has been recognized in Russia as one of the disciplines underlying agriculture and medicine and has received a large measure of support. Professor Koltzoff, director of the Institute of Experimental Biology in Moscow, told me of how he traveled to Leningrad during the famine of 1920 with Lenin and some other members of the Central Executive. Lenin was to urge upon the responsible committee the diversion of some of the funds set aside for famine relief to the construction of a research institute for seed selection and plant breeding. "The famine to prevent," said Lenin, "is the next one and the time to begin is now." He carried his point and there was built with emergency funds the great Institute of Applied Botany which under the direction of Nikolai Vavilov became the center of the greatest plant breeding and seed selection service in the world. Vavilov himself became the world authority on the history of crop plants.

In 1921 also the American geneticist, H. J. Muller, took to Moscow strains of the vinegar fly *Drosophila* and there grew up the greatest center of theoretical research in this field outside of the United States. Although the impetus came from America, the Soviet workers soon took their own line, and there was founded under Tschetverikoff the important new field of population genetics for the study of the distribution of new hereditary characters in nature. In the hands of Dubinin, Timofeef-Ressovsky and Dobzhansky, the latter now in the United States, this developed into the most important new experimental approach to the problems of evolution. Out of Soviet genetics have come also new ideas of chromosome structure, of the origin of mutations and new ideas on the arrangement and relations of the hereditary particles, the genes, by very many workers. By 1940 Moscow had in fact become one of the most important centers of work of this kind.

The comparative scope of genetical work in the U.S.S.R. and the esteem in which it is held is illustrated by the fact that in this third year of Russia's participation in the war, she is still the largest foreign subscriber to the chief American scientific journal in this field. More copies go to the U.S.S.R. than to all other foreign countries. Moreover, a standard American text-book which appears in the United States in editions of 2,000 copies is printed in the U.S.S.R. in editions of 15,000.

The spirit in which the Soviet scientists carried on their studies in the difficult days just after the revolution is again in evidence to-day. After the fall of Kiev I received a letter from Professor Gershenson, director of the Genetics Institute of the Ukrainian Academy of Sciences at Kiev, telling of the destruction of the institutes and the loss of the libraries. The personnel had been evacuated to two small towns, one in the Urals and one in Turkestan, and there they were continuing their work. They needed, he wrote, recent American publications and some stocks of Drosophila. We are now collecting books and journals to send to replace those destroyed by the Nazis.

There are to-day literally hundreds of trained genetical investigators in the U.S.S.R., certainly more than in any country outside of the U. S. A. They had already outstripped the Germans in this field even before the advent of Hitler put the quietus on German genetics. Soviet theoretical genetics has developed in close connection with practice, especially with agriculture and medicine, and has been continually

aware of the relationship between its own theoretical structure and the social theory on which the development of the U.S.S.R. has itself been based.

Other aspects of biological research which have shown great expansion and activity include the remarkable outburst of exploring and collecting zeal by which the animals and plants of the vast and varied autonomous republics and of China became known. This began immediately after the Revolution and has resulted in a great enrichment of the museums and in works of first-class importance by both zoologists and botanists. At the same time there began the development of institutes of experimental biology from which has issued important work in experimental morphology, on the analysis of growth, in endocrinology, in physiology and in biochemistry. In the latter field for example the discovery that the contractile protein, myosin, which is the basic component of muscle, acts as an enzyme, was of first-rate significance; while we all have increasing reason now to remember that much of the pioneer work on blood transfusion and plasma storage was done in the Soviet Union. The methods of artificial insemination, now used extensively in Europe and America, were developed almost wholly by Russian workers. It was estimated in 1941 that 50,000,000 farm animals in the Soviet Union alone had been produced by artificial insemination.

In recent years there have appeared in the Russian scientific literature new hybrid names indicating the fusion of independent scientific disciplines to focus on problems which transcend particular fields. Such is biogeochemistry, as conceived by Vernadsky and his group of the Biogeochemical Institute of the Academy of Sciences at Leningrad. Vernadsky took as his field the distribution of chemical elements due to living organisms in the biosphere and has added greatly to our knowledge of the chemistry of alluvial soils and the chemical composition of organisms.

Biological progress in the Soviet Union has not been achieved without cost and sacrifice. At a time when food was scarce they still spared some for their experimental animals and for costly scientific equipment. They took the means to build up science literally out of their necessities, not, as we have done, out of our surplus; and they had only themselves to look to, for the great foundations, which poured their funds for pure research so generously into Germany and western Europe, were never able to make the same arrangements in or for the Soviet Union. Yet in the U.S.S.R. was what in 1927 seemed to me to have been the greatest potential source of new scientific strength in the old world.

Some part of the cost was paid too in the creation of the central control of science which led to what we call red tape and the Russians "spoiling paper," and to an appearance of arbitrariness whenever decisions are made by a central authority. I have no doubt there was wailing and gnashing of teeth on the part of the individual investigators when before the war one of the great biological institutes was suddenly moved from near Leningrad to Moscow, but in view of what the Germans did to Leningrad, I can not believe that the regret of those biologists has survived to the present. These costs, together with other and greater ones, have been and are being paid, and we can now see that not only Soviet citizens but those of all countries stand to reap the benefits.

The progress of biological research in the Soviet Union has taught us a very valuable lesson. It is that control and organization of science by and for the whole community does not kill the scientific spirit or initiative nor submerge the individual scientist in a dead level of anonymity. Great individuals have arisen in Soviet biology, fine discoveries have been made and continue to be made even in the midst of war. Ivan Pavlov, one of the greatest of Russian biologists, began his scientific life under the old régime, but he lived to refute both in word and in deed the dire prophecies of those who said that great scientists and a vital and vigorous science could not survive in a socialist state.

For the sake of biological science itself, we biologists should use all our efforts to see that the barriers which separated Soviet biology and biologists from us should never again be allowed to prevent the free flow of persons and ideas, both scientific and social, on which the progress of science and of society depends.

RUSSIAN EXPLORATIONS[1]

By Sir HUBERT WILKINS

THERE have been many great Russian explorers, and the framework of Soviet Russia's exploration was laid down long before the advent of the Soviet Union.

Under the direction of the leaders and organizers of the Soviet Union the platform for exploration, as well as for many other scientific and cultural institutions, was preserved and they have been built up expertly and vigorously by Soviet scientists.

In recent years Soviet explorers have been especially active. I venture to say that in no other country has exploration and the exploitation of the results of ex-

[1] Address at the luncheon of the Congress Celebrating the Tenth Anniversary of American-Soviet Diplomatic Relations, New York, November 6, 1943.

ploration been more energetically and expertly developed and applied than it has been in the Soviet Union.

Modern Russia has been so successfully engaged in so many phases of exploration that it is difficult to say which field has been the most impressive. Political, social, economic, industrial, agricultural, medical, surgical, physical, physiological, geophysical and military phases have each been given intensive attention and the progress the Russians have made in each field is astounding.

There is much that may be said in relation to each and every phase, but because of my association with life in high latitude areas I might be expected to say most about the work that has been done by Soviet explorers in those areas.

They have done much in both the Arctic and sub-Arctic. The Arctic and sub-Arctic areas have long been known to be friendly to those who know and understand them and the Russians, who know them, have found them friendly and profitable. The Russians have done more toward the development and exploitation of their Arctic lands and waters than has either the United States or Canada in their northern territories.

And the developments that have taken place have been of great value to the Russians in relation to the present furious military struggle. From their northern areas the Russians have taken much of the timber and the mineral which have enabled them to so successfully develop the might and power that has already beaten the greatest army and the greatest accumulation of war force the Germans have ever assembled.

From northern lands which were, until a few years ago, known only to the so-called "natives" and the few explorers who ventured into them has come an enormous wealth of supplies.

Rivers which a few years ago were only shown vaguely as irregular lines on a comparatively featureless map, have been harnessed to provide the power which has enabled the production of millions of feet of sawn timber for home use and export. These rivers have also supplied the power to operate mines which have been developed in areas almost entirely unknown, until Soviet geologists recently surveyed them. From these mines have come the wealth of metal which is now being strewn in death-dealing blows at the civilized world's common enemy.

It is not only the foresight and the enterprise of the explorers of the Soviet Union that we must admire, we must admire also the attitude of their political and economic leaders who saw fit to exploit the knowledge the explorers brought home.

The possibility of such exploitation is, of course, dependent upon ways and means to exploit the fields explored and that is why, in the consideration of Soviet exploration, we must not forget the men who as explorers in the field of mechanics have produced the mechanized transport which has made it possible to enter the areas explored and bring from them the fund of wealth they provide.

With airplanes, suitably winterized for operation in such areas the Soviet aviators have carried out the aerial mapping of the Russian Arctic and sub-Arctic areas on such a scale as has seldom been applied to outlying regions in any other country.

I am told that the charting of the coastal or near coastal waters of the Soviet Union's northern borders is almost as detailed as is the charting of our own eastern shores. This is an achievement of no small order for the charting of the Arctic seaboard is not a simple hydrographic matter. There is the element of sea ice to contend with and the influence of distant meteorological activities to consider, for these meteorological influences are distributed irregularly and over a far greater area than are the meteorological influences transmitted through ice-free water.

With the use of and in combination with observation from airplanes the Soviet Merchant Marine has been able to make valuable use of their Arctic seaboard which for years was thought to be utterly impassable. The Soviet merchant fleet and their navy has now made the Northeast passage an established fact.

The opening up of the Northeast passage has opened up tremendous possibilities for traffic in the many northward flowing rivers in the Soviet Arctic and, in turn, great exploitation of the rich sub-Arctic lands.

The Soviet ventures into the inner realms of the Arctic Ocean have not been simple, adventurous endeavors, nor have they been of purely academic interest. They have had a definite, economic complex. The knowledge gained by the Soviet Scientists Polar Drift Expedition for instance has been exceedingly helpful in the prediction of ice movement and subsequent air temperatures and in turn, seasonal conditions. This knowledge has been of great value to military strategists.

The observations made in regard to the ocean currents have been invaluable in relation to the periodical difference in distribution of fish life and of great value to the fishing industry in general.

The soundings of the Arctic Ocean made by the intrepid Soviet airmen who flew out and landed several times on the pack ice far from shore are of extreme interest to geophysicists who are concerned with the structural formation of the world and the knowledge gained by the Soviet scientists has presented a new aspect of the earth's outline.

Soviet researches in relation to magnetism and

magnetic disturbances have been extensive and they are very valuable. The magnetic charts of the Soviet Union are, I am given to understand, much more detailed in relation to the Western Arctic and Siberia than are any U. S. charts of northern areas.

These magnetic observations are of great help to navigators of the air and sea in those areas which are more than often fogbound and so cloud covered as to restrict astronomical navigation.

But the greatest aids to the detailed exploration of the northern areas are the heavy tractor and the "cat trains" which have ploughed their way through swamps and tundra and over highlands and plateaus. We in this country have heard a great deal about the Alaska Highway and the Burma Road. Within the Soviet Union there are several "Alaskan Highways" and many hundreds of miles of "Burma Road" which winds over terrain equally as difficult as anything to be found in China or Burma.

It is, as a matter of fact, over such roads which lead to Kunming and Chungking that the Russians have delivered to the Chinese so much of the ground-warfare supplies that have been used by the Chinese in their successful resistance against the Japanese.

Great web-ways of tractor roads over Russia have opened great and rich food-producing areas in Central and in Northern districts and have played no small part in the glorious successes of the Soviet Army.

In the far north tractors have provided the means for transport throughout a great part of the year, but they operate most successfully during the depth of winter when the ground and the swamps and the rivers are solidly frozen over.

Such transportation has opened up vast fields for occupation and this in turn has led to much exploration in the Soviet Union in respect to soil chemistry and the development of a quick-growing variety of grain-producing plants. Wheat, oats and barley suitable for growing in the short Arctic summer season have been developed on the agricultural farms for research in the Soviet Union. And in respect to these findings, the Soviet scientists have given liberally to others in many parts of the world. The rich harvests produced in northern Canada are, in a great measure, due to the research and results of Soviet scientific exploration.

The development of such grain-producing, short-season varieties of plants is a matter of great importance to the United States if, for instance, the development of Alaska is undertaken. There are millions of acres in Alaska which are as suitable for development as the millions of acres in similar latitude and climatic conditions in the Soviet Union. The difference is, mainly, that there is no population in Alaska to take advantage of these areas.

There are others at this meeting who will tell you of the civic and cultural explorations within the Soviet Union, but I believe that only those of us who were privileged to see the beginning of that splendid and healthy development and who were in a position to realize the magnitude of the task can appreciate fully the tremendous progress that has been made in the Soviet Union between the years of 1923 and 1943.

How far such developments will effect the friendly cooperation of the two great countries, the U. S. A. and the U.S.S.R., is a matter for mutual consideration. It is my belief that such friendliness and cooperation can and should be boundless.

The magnitude of the cooperation might depend largely on the development the United States is prepared to make in her northern areas. But whatever the efforts of the United States may be, it can be taken for granted that through the field of exploration, followed by healthy, energetic exploitation, the U.S.S.R. will shortly, as world time is measured, be able to stand side by side with the United States in no disproportionate stature. And it will not be long, as world time is measured, before the U.S.S.R., with her multitudinous population and tremendous resources, will stand towering above the United States in material and economic magnitude. This is a matter for pleasant contemplation, provided we encourage and maintain the cooperation that is greatly to be desired.

SOME MODERN CONCEPTIONS OF AMEBIASIS
II

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PATHOLOGY AND SYMPTOMOLOGY

It is not the purpose of this paper to provide a clinical description of amebiasis but rather to analyze some of the fundamental evidence on host-parasite inter-relationship in amebiasis which may assist the clinician in visualizing his problems. A clear picture of the levels at which the amebic lesions occur, their numbers and the depths of penetration of the amebae constitutes the essential fundamental background for a clinical appreciation of the disease. Thus, a mucous

diarrhea, with amebic trophozoites in the stool, but without macroscopic blood suggests early, rather extensive superficial invasion of the bowel wall or a mild relapse, while a fulminating dysentery indicates deep invasion in at least one focus, usual in the rectal area.

Perhaps the most commonly overlooked syndrome which should suggest the possibility of amebiasis, especially in tropical countries, is that of appendicitis. Amebic lesions in the cecum, appendix or adjacent levels of the ileum or ascending colon may give rise to dull throbbing or intense knife-like pain in the lower right quadrant of the abdomen or by reference the pain may suggest gall bladder disease or peptic ulcer. Patients having infection at this focus may consistently pass stools which are formed or constipation may alternate with diarrhea. In New Orleans 10 per cent. of appendicitis cases in the surgical service of Dr. Alton Ochsner in Charity Hospital were found to have amebic involvement.[69] In the Santo Tomas Hospital in Panama the frequency has been one third of appendicitis cases coming to operation. Early recognition by the clinician of the frequency of amebiasis of the cecal area usually allows management of the case by the internist and prevents unnecessary surgical intervention, since anti-amebic therapy in these cases will probably eventually be required.

Asyndromic amebiasis[70] may cause general colonic disturbance, nervous symptoms or fatigue. In such patients one or more well-established amebic ulcers have usually developed, most commonly in the cecal area.

In chronic amebiasis the amebic lesion is usually secondarily infected with bacteria, which provokes an infiltration of neutrophilic leukocytes. Moreover, in this type of amebiasis a moderate leukocytosis is frequently observed in the circulating blood, so that the blood picture disguises the diagnosis of amebiasis.

Amebic invasion of the liver is probably much more common than the records of acute hepatic amebiasis indicate. Amebae which enter the mesenteric venules in the submucous coat of the large bowel are swiftly carried to the liver, to be filtered out in the portal capillaries. In the great majority of cases the amebae do not colonize in the liver parenchyma but soon die. The cause of this amebostatic action is unknown, but it is plausible that the same unknown substance in liver extract which has been found experimentally to control the infection in the bowel operates even to a greater degree in the liver itself. If the suggestion may be carried one step farther, it is possible that a quantitative reduction in the production of this as yet unknown fraction of liver extract allows the amebae to multiply, with resultant amebic hepatitis or liver abscess.

[69] A. Ochsner, *Surgery*, 1: 633–636, 1937.

[70] J. S. D'Antoni, *New International Clinics*, Ser. 5, 1: 101–109, 1943.

Diagnosis

While an internist who has had years of experience in the study of dysenteries can frequently make an accurate diagnosis of fulminating amebic or bacillary dysentery on the macroscopic appearance of the freshly passed stool, this method does not provide a safe basis for diagnosing amebiasis in its broader aspects. In practice it is necessary to recover *Endamoeba histolytica* itself either in its trophozoite or cystic stage, and to differentiate it from other protozoa of the digestive tract as well as from macrophages and *Blastocystis*.

Visualization of the organism can be accomplished from microscopic films prepared from formed, semi-formed or liquid stools, from purgative or enema specimens, from proctoscopic material or after *in vitro* culture of the ameba. None of these is 100 per cent. efficient.

In the laboratories of the Department of Tropical Medicine of Tulane University the following routine method of examination for *Endamoeba histolytica* has been in operation for several years. First of all, microscopic films of the freshly passed stool are prepared. These consist of (1) a direct film, one side unstained, one side stained with D'Antoni's iodine; (2) a supplementary hematoxylin-stained direct film; (3) a film resulting from concentration of cysts by the zinc sulfate centrifugal flotation technique. Three stools, passed on alternate days or preferably every third day, are examined in this way. Both by practical tests and by calculation it has been found that 85 to 90 per cent. of positive cases are diagnosed by these combined techniques on the three stool samples, whereas a single direct fecal film accounts for only 20 to 25 per cent. of *E. histolytica* positives. In individual cases with a history of chronic colitis proctoscopic examination, purgation with Glauber salts or phospho-soda, or high physiologic salt enemas are carried out.

While cultures of the specimen on *E. histolytica* culture media are satisfactory for the demonstration of the organism recovered from liquid or semi-liquid stools, cysts of this organism at times fail to excyst in the culture medium, thus providing false evidence of a negative.

In areas or population groups of high endemicity, in which there is not only a high incidence of infection in the population but also a large number of amebae per individual, evidence of infection is readily obtained from stool examination. In areas of low endemicity, in which the incidence is low and the average number of amebae per individual is small,

the problem of diagnosis is difficult or at least tedious. In the United States very high incidence occurs in certain population groups, as in rural areas of the Southern Appalachians and in children's asylums in New Orleans. In other areas, particularly in the north, the incidence may be as low as 1 per cent., although in most regions it varies between 5 and 10 per cent. The ease or difficulty experienced in the diagnosis of *Endamoeba histolytica* in any particular locality will depend not only on the skill of the diagnostician and the methods which he utilizes but also on the wealth or dearth of the amebae in the patient's feces.

Treatment

It would be unsuitable for the writer to deliver a set of dicta on anti-amebic treatment for the practising physician, but there are certain basic observations which are relevant and proper.

Twenty-five years ago ipecac was commonly utilized in the treatment of acute or chronic amebic colitis. It frequently cured the patient who could retain enough of the drug to act on the amebae. Meanwhile emetine hydrochloride had been demonstrated to be very effective in bringing the infection under control and particularly in alleviating symptoms. Stovarsol (acetarsone), originally prepared by Ehrlich, was first utilized by the French for the treatment of syphilis and African sleeping sickness, but by 1920 it was found to be effective in the control of amebiasis. Because of the high percentage of patients taking the drug who developed severe intestinal colic as well as other types of arsenic intolerance, this product has been practically replaced in recent years by less toxic anti-amebic drugs. Carbarsone, another arsonic acid compound originally prepared by Ehrlich, was introduced by Anderson and Reed in 1931[71] as a highly specific drug for the treatment of amebiasis and was described as much better tolerated than stovarsol. Meanwhile, in 1921, Mühlens and Menk[72] advocated the use of chiniofon, an iodo compound which they introduced under the trade name "Yatren." This drug was soon given extensive clinical trial and found to be a very efficient and well-tolerated anti-amebic drug. In 1936 diodoquin, another iodo compound, was released by Searle for clinical trial in the treatment of amebiasis. Its use is gradually being extended as its anti-amebic value and high tolerance are being demonstrated. Vioform, a third iodo compound, has been recommended for the treatment of amebiasis but has never been widely used.

To-day the drugs most commonly prescribed for amebiasis in the United States are emetine hydrochloride, carbarsone, chiniofon and diodoquin. Emetine hydrochloride is the only known eminently satisfactory preparation for the treatment of amebic hepatitis and amebic liver abscess. For amebiasis of the intestinal tract its usefulness consists primarily in controlling acute symptoms, but within limits of safe administration it can not be guaranteed to terminate the infection. For routine treatment of amebic colitis, whether acute, chronic or "carrier type," carbarsone, chiniofon and diodoquin constitute the present-day drugs of choice. For patients with arsenic intolerance one of the iodo preparations should be utilized. Moreover, in experimental amebiasis in the dog the writer and a junior colleague[73] have recently demonstrated that carbarsone has only a 75 per cent. amebicidal efficiency compared with chiniofon. For a short course of treatment chiniofon is most likely to eliminate the infection, but in some persons it provokes a severe watery diarrhea. Diodoquin apparently has no contraindications, but requires a longer period of treatment because of its slower absorption rate into the bowel wall.

An analysis of the present status of chemotherapy in amebiasis indicates that marked progress has been made in the past quarter of a century in the development of a few relatively specific drugs which are rather well tolerated by the patient. Yet in amebic colitis no one of these drugs and occasionally no combination of them provides a guaranteed cure. There is abundant need and opportunity to explore other preparations, including refined products of crude drugs utilized by Oriental and Amerind peoples, as well as new synthetics.

Finally, a suggestion may appropriately be made concerning the nutritional state of the patient in amebiasis. Experimental evidence suggests that during the period of treatment the carbohydrate intake should be reduced and that nutritious, readily digestible animal proteins should be increased. The possible role of vitamins in raising the threshold of resistance to the pathogen has never been given experimental or clinical trial, either in preventing infection or in controlling tissue invasion. This suggests the need for serious intensive study.

Control

Justification of preventive measures in any particular disease is based on two premises: (1) that the disease is clinically important and (2) that it is a public health hazard. In an infection like amebiasis it is easier to dodge the issue than to meet it squarely and to provide machinery for practical control. Yet an honest evaluation of the evidence in amebiasis

[71] H. H. Anderson and A. C. Reed, *Calif. and Western Med.*, 35: 439–443, 1931.

[72] P. Mühlens and W. Menk, *Münsch, med. Wochenschr.*, 68: 802, 1921.

[73] E. C. Faust and J. E. Tobie. Unpublished experiments.

definitely indicates its actual or potential danger to individuals and communities which harbor the etiologic agent.

The problem of control is somewhat simplified by remembering that reservoir hosts play no important part in the propagation of amebiasis, so that man may thank himself for the infection. Moreover, the individual who is least likely to manifest symptoms, namely, the so-called "carrier case" who is passing cysts in his stools, is the primary offender. Exposure occurs through entry of viable infection-stage cysts of *Endamoeba histolytica* as a contamination into the mouth. Infection may occur from a single massive dose of cysts, or from repeated lighter doses taken into the mouth in food or water. While the epidemiologic evidence is not conclusive, it is apparent that the safeguarding of food and drink from contamination should do much to protect the population. The public must be made aware that dirty food handlers should not be tolerated. By sanitary regulations these individuals should be examined for amebic infection and, if found positive, should be treated until they are negative. Filth flies should not be allowed to breed; they are not only a menace in this infection but in practically all other diseases primarily involving the gastro-intestinal tract. Thorough sanitary campaigns should be carried out in eleemosynary institutions to clean out these hotbeds of infection. An awakening of the public consciousness regarding the potential dangers of amebiasis constitutes an additional essential part of the control program. Meanwhile the practicing physician, by his respectful attitude towards amebiasis in his own patients, whether they manifest symptoms or are apparently symptomless, can do much to further this end.

Conclusions

The material which has been presented in this paper is not intended for immediate practical application by the clinician but as a basis for reorientation and re-evaluation of the problem of amebiasis. Some of the remarks are personal reflections of the writer which have never previously been expressed except in informal conferences. It is believed, however, that the subject justifies this type of presentation. It is the writer's sincere hope that some little stimulus will have been provided which will aid the physician and the epidemiologist in elucidating the several obscure aspects of the problem of amebiasis, so that in the future practical means may be found for its control.

It has been a very real honor to be the 1943 recipient of the Alvarenga Prize of the Philadelphia College of Physicians and a privilege to address this distinguished body.

OBITUARY

L. CHARLES RAIFORD

Professor L. Charles Raiford died on January 8 at the age of seventy-one years after a very short illness. He is survived by a daughter, Mrs. Mark Hagerman, of Towanda, Pa., and a grandson, Mark, Jr.

Professor Raiford was born on August 2, 1872, in Southampton County, Va. He received the Ph.B. degree at Brown University in 1900, the M.A. in 1904 and the Ph.D. at the University of Chicago in 1909. He was on the teaching staff at the Mississippi Agricultural College, the University of Chicago, Clemson College, the University of Wyoming and the Oklahoma A. and M. College before going to the University of Iowa in 1918, where he served as professor of organic chemistry up to the time of his death. He was also head of the division of organic chemistry until 1942 when he reached the age of seventy years. During this period he directed the research of over a hundred graduate students for advanced degrees. These are scattered all over the United States in teaching and industrial positions.

Professor Raiford was a fellow of the American Association for the Advancement of Science, a member of the American Institute of Chemists, the American Chemical Society, the American Association of University Professors, the Oklahoma Academy of Science, the Iowa Academy of Science, Sigma Xi, Phi Beta Kappa, Phi Lambda Upsilon, Alpha Chi Sigma, Phi Delta Chi, the Research and Triangle Clubs. In the American Chemical Society, he served as national chairman of the organic division in 1937. In the local section of that organization, he served as chairman and secretary and was elected councilor nine times, a very notable record which indicated his popularity and standing in the profession.

Professor Raiford was active in these societies and always willing to do any service, no matter how much work was involved. He was president of Phi Beta Kappa in 1922–23 and was local secretary of that organization when a national directory was prepared, to which undertaking he contributed by gathering the necessary data for the members of the Iowa chapter. He represented the department of chemistry on the library board for many years, and the excellent maintenance of the chemistry library was due in great measure to his efforts. He served as president of the Research Club.

In 1942, when he reached his seventieth birthday, a testimonial dinner was given in his honor at the Alpha Chi Sigma chemical fraternity at which addresses were

given by faculty colleagues and letters read from former students. At that time a watch was presented to him from former students and members of the local chapter of Alpha Chi Sigma.

Professor Raiford was the author of a "Laboratory Course in Color Chemistry," since 1936 a member of the board of editors of the *Journal of Organic Chemistry,* and contributed many articles to scientific journals.

Funeral services were held on January 11. Dr. M. Willard Lampe officiated, and honorary pallbearers were Edward Bartow, Perry A. Bond, George H. Coleman, Jacob Cornog, Homer R. Dill, George Glockler, Hubert L. Olin, Henry A. Mattill and J. Hubert Scott.

GEO. GLOCKLER
THE STATE UNIVERSITY OF IOWA

LEVIN BOWLAND BROUGHTON

L. B. BROUGHTON, dean of the College of Arts and Sciences of the University of Maryland, died suddenly at his home in College Park, Md., on December 13, 1943. A correspondent writes:

"Dean Broughton was born in Pocomoke City, Md., on March 29, 1886. In 1908 he was graduated from the Maryland Agricultural College, by which college he was awarded the M.S. degree in 1911. He received his Ph.D. in chemistry from the Ohio State University in 1926. Dean Broughton's association with the University of Maryland continued from 1904 until his death. After graduation he was assistant chemist at the Experiment Station until 1916. He then became, in succession, associate professor in 1916, professor in 1918 and department head in 1929, on which date he also became state chemist of Maryland. In 1938 he was appointed dean of the College of Arts and Sciences, which office he filled with marked success until the day of his death. Within the year Governor O'Conner appointed him a commissioner of the Maryland State Department of Geology, Water Resources and Mines. He was best known for his researches in agricultural chemistry. Among these were studies in soil acidity, the ascaridole content of chenopodium oil, potash as a by-product of alcohol production, biological changes in pork during curing and vitamin assays. During 1941 he was honored with the presidency of the Association of Official Agricultural Chemists. He was also a member and sometime councilor of the American Chemical Society, Sigma Xi, Alpha Chi Sigma, Kappa Alpha, Phi Kappa Phi, Omicron Delta Kappa and the Rotary Club."

RECENT DEATHS

DR. J. MCKEEN CATTELL, editor of SCIENCE for nearly fifty years, formerly professor of psychology at Columbia University, died on January 20 in his eighty-fourth year.

DR. COLIN C. STEWART, Brown professor of physiology at Dartmouth College, died on January 22 at the age of seventy years. He had been a member of the Dartmouth faculty for the past forty years.

DR. FREDERICK SCHEETZ JONES, formerly professor of physics and electricity at the University of Minnesota, where he became dean of the School of Engineering in 1902, died on January 14 at the age of eighty-one years. He was dean of Yale College from 1909 to 1927.

DR. ALBERT E. TAUSSIG, professor of clinical medicine at the Washington University Medical School, a former director of medical service of the Jewish Hospital of St. Louis, Mo., died on January 16 at the age of seventy-two years.

ROBERT S. LEHMAN, a member of the firm of Alfred and Robert S. Lehman, retail druggists of New York City, a former president of the New York State Pharmaceutical Association, the Academy of Pharmacy and the Pharmaceutical Council, died on January 15 at the age of seventy-six years.

SCIENTIFIC EVENTS

GIFT TO THE UNIVERSITY OF OXFORD FOR PLASTIC SURGERY

IT is reported in *The Times,* London, that the Nuffield Provincial Hospitals Trust, at Lord Nuffield's suggestion, has offered the University of Oxford £8,000 a year for ten years towards the cost of establishing and maintaining a plastic surgery unit there. The university has accepted the offer with gratitude and has appointed Thomas Pomfret Kilner as the first director of the plastic surgery unit with the title of Nuffield professor of plastic surgery. The Radcliffe Infirmary will provide hospital facilities for the unit, and these will be supplemented by the Ministry of Pensions.

Lord Nuffield's direct personal gifts to the University of Oxford for the purpose of the development of the Medical School amount to £2,810,000. His series of great and related benefactions began in 1930 with the purchase of the Observatory Buildings and grounds adjoining the Radcliffe Infirmary, which he gave to the university to be used for the purpose of medical teaching and research, this being followed by a second gift of £2,000,000 for the development of the Medical School.

The new unit will be a center for the training of plastic surgeons, and will work in close touch with the university laboratories in which parallel investigations of the biochemical and other problems connected with the growth and repair of tissue, fundamental to plastic surgery, will be carried on. It is felt that there is an urgent need to have such a center in Great Britain.

The war has brought a greatly increased demand for the services of plastic surgeons and Lord Nuffield's proposal was chiefly influenced by a desire to provide the best possible treatment for casualties, especially those suffering from disfigurement caused by burns. Even though the demand may be less after the war, plastic surgery will have, unquestionably, a most important part to play in the services which are being envisaged by the government for the rehabilitation of injured persons.

AFFILIATION OF PSYCHOLOGICAL ORGANIZATIONS

IT is reported by Science Service that a movement is now on foot to combine the nine leading national psychological associations and groups of psychologists into a single national association. Details of the merger are being worked out by a committee appointed by representatives of all the present organizations.

Final action ratifying the new constitution is expected on the part of the two largest organizations, the American Psychological Association and the American Association for Applied Psychology, in September. Difficulties may arise due to the fact that the annual business meetings of these organizations were cancelled last year due to war-caused transportation difficulties. It is not now known whether a meeting will be held for this purpose, whether action will be taken by the administrative councils of the organization or whether members will be asked to vote by mail.

The new organization, which will also be called the American Psychological Association, will have, it is planned, a number of divisions, each with its own chairman, secretary and other officers. The divisions will sponsor programs, the annual meetings and may also publish journals. Any member may belong to one or more divisions.

Government of the new association will be by a council of representatives to be elected by the various divisions and regions and by certain unorganized groups. The council will meet annually and elect a board of directors and several other boards and committees to do the work of the association.

It is anticipated that 4,000 psychologists will be members of the new association. Organizations that appointed representatives to plan the merger include the American Psychological Association, the American Association for Applied Psychology, the Society of Experimental Psychologists, the Society for the Psychological Study of Social Issues, the Psychometric Society, the National Institute of Psychology, the National Council of Women Psychologists, the Department of Psychology of the American Teachers Association and Section I of the American Association for the Advancement of Science.

THE CLEVELAND MEETING OF THE AMERICAN CHEMICAL SOCIETY

THE one hundred and seventh meeting of the American Chemical Society, under the presidency of Dr. Thomas Midgley, Jr., will be held in Cleveland from April 3 to 7. Several thousand chemists and industrialists will participate.

Fourteen of the eighteen professional divisions of the society will convene. Postwar planning will be emphasized at the sessions of the division of industrial and engineering chemistry under the chairmanship of Dr. Lawrence W. Bass, of Boston. Progress in petroleum chemistry will be described before the petroleum division, of which Dr. Cecil L. Brown, of the Standard Oil Company of Louisiana, Baton Rouge, is chairman.

"Antiparasitic Agents as Used in Tropical Diseases Other than Malaria" will be the general theme of the division of medicinal chemistry, of which Dr. John H. Speer, of G. D. Searle and Company, Niles Center, Ill., is chairman. "The Biological Value of Proteins" and "Carbohydrates for Industrial Use" will be discussed at a joint meeting of the division of agricultural and food chemistry and the division of sugar chemistry. Papers on vitamins will be read at a session of the agricultural and food and biological divisions.

"Industrial Demands for Non-Laboratory Chemists" will be the topic of the division of chemical education, of which Dr. Laurence L. Quill, of the Ohio State University, is chairman. Papers on "Detergents and Their Actions on Biological Systems" and "Theory of Long-Range Elasticity" will be submitted to the division of physical and inorganic chemistry, of which the chairman is Dr. Oscar K. Rice, of the University of North Carolina.

General sessions will be held by the divisions of analytical and micro-chemistry, cellulose chemistry, colloid chemistry, gas and fuel chemistry, organic chemistry, sugar chemistry and technology, and water sewage and sanitation chemistry.

Registration will begin on Sunday, April 2, at the Hotel Cleveland and the Hotel Statler, joint headquarters for the sessions. Divisional meetings will take place in the Cleveland Public Auditorium beginning on Monday, April 3, at 2 P.M. and ending on Friday at 5 P.M. The council, of which Dr. Midgley is chairman, will meet on Monday at 9:30 A.M. A general meeting is planned for Wednesday at 2:00 P.M. The semi-annual dinner meeting will take place on Wednesday at 7:00 P.M.

Dr. Carl F. Prutton, professor of chemical engineering at Western Reserve University, has been appointed general chairman of the meeting. Dr. Eric A. Arnold, associate professor of chemistry at the Case School of Applied Science, has been named general vice-chairman. Dr. Harold S. Booth, head of the department of physical science at Western Reserve, is honorary chairman.

Vice-chairmen to direct the work of local committees on arrangements for the convention are W. J. Bartlett, Mathew M. Braidech, G. H. McIntyre, A. S. Weygandt and F. M. Whitacre.

AWARDS OF THE INSTITUTE OF THE AERONAUTICAL SCIENCES

THE Institute of the Aeronautical Sciences under the presidency of Major R. H. Fleet opened its twelfth annual meeting with the "honors night" dinner in the Waldorf-Astoria, New York City, on January 24. The following awards were made:

General Henry H. Arnold, commanding general of the Army Air Forces, an honorary fellowship, presented by Brigadier-General Frank P. Lahm, retired.

Sir Richard Fairey, director-general of the British Air Commission, an honorary fellowship, presented by T. P. Wright, of the War Production Board.

Sanford A. Moss, consulting engineer of General Electric, the Sylvanus Albert Reed award, presented by Charles L. Lawrence, head of Lawrence Engineering and Research.

Lieutenant-Colonel Joseph J. George, of the Army Air Forces Weather Division, the Robert M. Losey award, presented by F. W. Reichelderfer, chief of the United States Weather Bureau.

Brigadier-General Eugen G. Reinartz, commandant of the Army School of Aviation Medicine, the John Jeffries award, presented by Major-General D. N. W. Grant, air surgeon of the Army Air Forces.

William H. McAvoy, chief test pilot of the National Advisory Committee for Aeronautics, the Octave Chanute award "for continuous service in the flight-testing of experimental airplanes under hazardous conditions."

William B. Bergen, chief flight test engineer of the Glenn L. Martin Company, the Lawrence Sperry award, presented by E. G. Sperry, Jr., vice-president of Sperry Products.

Colonel H. F. Gregory, of the Army Air Forces, the Thurman H. Bane award "for his contribution to the military and commercial development and use of the helicopter," presented by Igor I. Sikorsky, of the Vought-Sikorsky Aircraft Division of United Aircraft.

THE GIBSON ISLAND RESEARCH CONFERENCES

THE seventh series of the Gibson Island special research conferences on chemistry of the American Association for the Advancement of Science will begin on June 12. There will be eleven conferences during the summer of 1944, each extending over a period of five days, from Monday to Friday, inclusive, on successive weeks. The final conference will open on Monday, August 21. The subjects of the eleven conferences are:

1. Petroleum Chemistry. June 12–16. Frederick D. Rossini, *chairman;* George Calingaert, *vice-chairman.*
2. Catalysis. June 19–23. Otto Beeck, *chairman;* P. H. Emmett, *vice-chairman.*
3. Organic Highpolymers. June 26–30. H. Mark, *chairman;* Emil Ott, *vice-chairman.*
4. Medicinal Chemistry. July 3–7. D. L. Tabern, *chairman;* W. G. Bywater, *vice-chairman.*
5. Textiles. July 10–14. Milton Harris, *chairman;* Warren F. Busse, *vice-chairman.*
6. Strategic Materials. July 17–21. Robert Calvert, *chairman;* Richard J. Block, *vice-chairman.*
7. Vitamins. July 24–28. Walter C. Russell, *chairman;* James Waddell, *vice-chairman.*
8. Cancer. July 31–August 4. Dean Burk, *chairman;* Ralph G. Meader, *vice-chairman.*
9. Corrosion. August 7–11. F. L. LaQue, *chairman;* G. H. Young, *vice-chairman.*
10. Instrumentation. August 14–18. W. G. Brombacker, *chairman;* J. G. Ziegler, *vice-chairman.*
11. X-ray and Electron Diffraction. August 21–25. Lester H. Germer, *chairman;* P. Debye, *vice-chairman.*

The island offers opportunities for golf, tennis, bathing in both salt and fresh water, fishing and swimming. Yacht races are held off the shore at various times during the summer.

The conference property was purchased and furnished by the association with gifts of $1,000 each from industrial companies whose laboratories have been represented at the conferences, each company having the right to have one representative at each conference. Attendance is limited to 60 persons, distributed as widely as possible among representatives of industrial, foundation and university laboratories.

Registration for the coming summer should be made before February 20 with the director, Dr. Neil E. Gordon, Wayne University, Detroit, who is secretary of the Section on Chemistry of the association.

SCIENTIFIC NOTES AND NEWS

THE Distinguished Service to Geography Award of the National Council of Geography Teachers has been given to President Wallace W. Atwood, of Clark University, "for his persistent efforts to advance geography, especially for his headship, since 1920, of the Graduate School of Geography at Clark University and his establishment and editorship of *Economic Geography* since 1925."

THE Edison Medal of the American Institute of Electrical Engineers was presented to Dr. Vannevar Bush at a general session of the institute on January 26. As already recorded in SCIENCE, the medal was awarded in recognition of "his contribution to the advancement of electrical engineering, particularly through the development of new applications of mathematics to engineering problems, and for his eminent service to the Nation in guiding the war research program."

THE International Acetylene Association presented at a dinner given on January 24 at the Union League Club, New York City, the James Turner Morehead Medal to Charles Ellison MacQuigg, dean of engineering at the Ohio State University, "for advancing the oxy-acetylene processes through metallurgical research and for leadership in engineering education."

THE Founders Gold Medal of the Horticultural Society of New York for "outstanding achievement in horticulture" was presented on January 19 to A. T. De La Mare, editor of *The Florists Exchange and Horticultural Trade World,* a weekly magazine that he has published for fifty-five years.

DR. FLORENCE B. SEIBERT, of the Henry Phipps Institute, associate professor of biochemistry in the University of Pennsylvania, has been elected, in recognition of her work in tuberculosis, a national honorary member of Sigma Delta Epsilon, the Graduate Women's Scientific Fraternity.

IT is reported in the *Journal* of the American Medical Association that Dr. Robert Denison, president of the Harrisburg, Pa., Academy of Medicine, has received the Seibert Memorial Prize of $500. The award was established in memory of the late Dr. William Seibert by his sister and was originally intended for study abroad. It is given every two years to a member of the academy who has done notable work.

DR. THOMAS J. HEADLEE, known for his work on mosquito control in New Jersey, retired on January 1 with the title emeritus after serving since 1912 as chief of the department of entomology of Rutgers University and of the State Agricultural Experiment Station. Dr. Bailey B. Pepper, associate entomologist, has been named acting head of the department. A tea was given in honor of Dr. Headlee on the occasion of the annual conference of the New Jersey Extension Service. It was attended by many county extension workers as well as by members of the faculty of Rutgers University who had worked with him from time to time. Dr. William H. Martin presented Dr. Headlee with a chair and a lamp on behalf of the staff of the institution.

MALCOLM PIRNIE, sanitation engineer of New York City, has been elected president of the American Society of Civil Engineers, and Richard E. Dougherty, vice-president of the New York Central Railroad, has been elected vice-president. They took office at the annual meeting on January 17.

CHANCELLOR SAMUEL P. CAPEN, of the University of Buffalo, was elected at the annual meeting held in New York City on January 19 president of the Association of Colleges and Universities of the State of New York.

THE following have been elected officers of the American Society for X-ray and Electron Diffraction: W. H. Zachariasen, department of physics, University of Chicago, *Vice-president* for 1944 and *President-elect* for 1945, and J. D. H. Donnay, Laval University, Quebec, and Hercules Powder Company, Wilmington, Del., *Secretary-Treasurer* for 1944. Dr. L. H. Germer, of the Bell Telephone Laboratories at Murray Hill, N. J., is president for 1944. The next meeting of the society will be a joint Research Conference with Section C of the American Association for the Advancement of Science next August at Gibson Island, Md.

AT the January meeting of the New York City Branch of the Society of American Bacteriologists, the following officers for 1944 were elected: *President,* Mrs. Mary B. Horton, Sheffield Farms Company, Inc., New York; *Vice-president,* Dr. Gustav I. Steffen, New York City Department of Health; *Secretary-Treasurer,* Dr. Mortimer P. Starr, Brooklyn College; *Corresponding Secretary,* Dr. C. Virginia Fisher, Warner Institute; *Program Committee,* Dr. William W. Browne, the City College.

DR. GEORGE MORRIS PIERSOL, professor of medicine in the Graduate School of Medicine of the University of Pennsylvania, past president of the American College of Physicians and a member of the Council on Physical Therapy of the American Medical Association, has been appointed director of the new Center for Research and Instruction in Physical Medicine in the Graduate School of Medicine of the university. To establish this center the National Foundation for Infantile Paralysis recently made a grant amounting to $150,000 for a five-year period from January 1, this year, to December 31, 1948.

DR. ROBERT C. MAJOR has resigned as assistant in surgery at the School of Medicine of Emory University, Atlanta, to become full-time professor of thoracic surgery at the School of Medicine of the University of Georgia at Augusta, effective on January 1. Dr. John Robert Rinker, Fort Worth, has been appointed full-time professor of urology at Georgia.

G. W. GROFF, who has been, since its founding in 1921, dean and director of the College of Agriculture

of Lingnan University, China, has been appointed lecturer on world agriculture at the Pennsylvania State College.

WHILE on leave of absence from the Graduate School of Medicine of the University of Pennsylvania, where he is a member of the faculty, Dr. Kehar Singh Chouke is serving, during the first six months of the current year, as visiting associate professor of anatomy at the School of Medicine of Washington University, St. Louis.

DR. ROBERT WILSON, since 1908 dean of the College of Medicine of the State of South Carolina, Charleston, associated with the college since 1893, has presented his resignation. He will be succeeded by Dr. Kenneth M. Lynch, who has been assistant dean since 1935.

DR. GEORGE R. COWGILL, of the School of Medicine of Yale University, has been promoted from an associate professorship of physiological chemistry to a newly established professorship of nutrition.

DR. GEORGE B. PEGRAM, professor of physics and dean of the Graduate School of Columbia University, and Dr. William J. Robbins, director of the New York Botanical Garden, have been elected members of the Council of the American Association for the Advancement of Science. Dr. Arthur H. Compton, professor of physics at the University of Chicago, and Dr. Elvin C. Stakman, professor of plant pathology at the University of Minnesota, have been elected members of the Executive Committee.

STANLEY FIELD has been reelected for the thirty-sixth consecutive year president of the Chicago Natural History Museum, formerly the Field Museum of Natural History.

DR. ISAIAH BOWMAN, president of the Johns Hopkins University, has been appointed by Secretary Hull a member of the policy committee of the Department of State recently organized "to facilitate the conduct of foreign relations of the United States in war and in peace."

THE United Fruit Company has announced the organization of a Department of New Crops. Dr. Atherton Lee, formerly director of the Puerto Rico Experiment Station of the U. S. Department of Agriculture and subsequently chief of the Natural Rubber Section, Office of the Rubber Director, will be director of the new department. First attention will be devoted to the production of tropical strategic crops for the war effort and subsequently of tropical food crops to aid after-invasion economy.

DR. RUFUS S. REEVES has been appointed for a four-year term director of health of Philadelphia to succeed Dr. Hubley R. Owen. He took office on January 3.

MAJOR GUSTAVE J. DAMMIN, of the Medical Corps of the Army, after serving for two and a half years at the Antilles Medical Department Laboratory, during the last year of which he was commanding officer, is returning to the continental United States to join another laboratory unit.

DR. L. J. WITTS, Nuffield professor of clinical medicine in the University of Oxford, and Dr. J. R. Learmonth, professor of surgery at the University of Edinburgh, have been appointed members of the British Medical Research Council.

DR. WILLIAM E. LADD, William E. Ladd professor of child surgery at the Harvard Medical School, gave the twelfth annual series of the Benjamin Knox Rachford Lectures on January 18 and 19. The lectureships were established as a memorial to Dr. B. K. Rachford in recognition of his work in the physiology of digestion and other scientific investigations.

DR. CHARLES F. CHURCH, chief of the medical department of E. R. Squibb and Sons, delivered recently lectures on "Penicillin—Its Background and Therapeutic Uses," before the Baltimore City Medical Society, the Georgia Pediatric Society, the University of Georgia Medical School, the District of Columbia Medical Society and the Philadelphia College of Pharmacy and Science.

THE annual meeting of the American Association of Cereal Chemists will be held on May 23, 24 and 25 at the Nicollet Hotel, Minneapolis. It is urged that all those who anticipate attending this meeting make their railroad and hotel reservations at the earliest possible moment so that a minimum of confusion and disappointment may result to those attending this convention.

A MEETING of leaders of nutrition research was held at the University of California at Berkeley on January 25 and 26. This is one of four regional meetings which will include all the states. The purpose of the conferences is to evaluate experiments in progress on the conservation of the nutritive value of foods.

A SYMPOSIUM on the industrial application of x-ray diffraction will be held at the Polytechnic Institute of Brooklyn, on Friday evening, February 25, and Saturday morning and afternoon, February 26.

BY the will of Dr. William Llewellyn Pryce Bevan the University of Edinburgh will receive a bequest of approximately £22,000 for the promotion of the teaching or the advancement of medical science.

THE Council of the National Institute of Sciences of India, according to *Current Science*, Bangalore,

has been authorized to take necessary steps for the organization of a National Research Council constituted under the statutory authority of the Government of India, at the symposium on Post-War Organization of Scientific Research held last October in Calcutta. It was also decided to approach the Government of India for an annual grant to enable the council to give effect to its policy of scientific development. The symposium considered that the National Research Council should be directly responsible to the government. Its main functions should be to plan the main lines of scientific work in accordance with national needs, to ensure balanced development of all branches of science and advise and help regarding the training and supply of scientific personnel for pure and applied research. The council should consist of scientific and technical experts not exceeding sixty in number, the majority of whom should be elected by non-official scientific organizations, including universities. Boards of research should be constituted for each sphere of work, and each board should be authorized to constitute research committees on all important subjects.

THE Pyrethrum Board of Kenya has been asked by the British Ministry of Supply to send 10,000 pounds of pyrethrum seed to the United States Board of Economic Warfare. The seed will be flown across the Atlantic and probably planted in Brazil.

A NATIONAL Department of Public Health and Social Assistance was recently established at Buenos Aires, of which Dr. Eugenio A. Galli, major surgeon, R. A., has been appointed president. It includes the National Department of Hygiene, the Advisory Committee of Regional Hospitals, the National Institute of Nutrition, the Society of Beneficence of the Federal Capital, the National Centers of Social Assistance, the Department of Subsidies and all the national branches of the departments of Public Health and Hygiene.

IN the British House of Commons, it was announced recently by Mr. Attlee, Lord President of the Council, that the government had decided to set up a Royal Commission to investigate the birth-rate and trends of population and that the Lord Chancellor had accepted the chairmanship. The terms of reference of the commission are to examine the facts relating to the present population trends in Great Britain; to investigate the causes of these trends and to consider their probable consequences; to consider what measures, if any, should be taken in the national interest to influence the future trend of the population and to make recommendations.

THE British Secretary of State for the Colonies, according to *Nature,* has appointed a Colonial Fisheries Advisory Committee to advise him on problems concerning fisheries (marine and freshwater) in the Colonial Empire, in association with his fisheries adviser. The committee is constituted as follows: The Duke of Devonshire, Parliamentary Under-Secretary of State for the Colonies, *chairman;* G. L. M. Clauson, Colonial Office, *vice-chairman;* Dr. S. Kemp, director of the Marine Biological Association of the United Kingdom; Dr. E. B. Worthington, director of the Freshwater Biological Association of the British Empire; Dr. E. S. Russell, fisheries adviser to the Secretary of State for the Colonies; Dr. G. A. Reay, director of the Torry Research Institute, Department of Scientific and Industrial Research, Aberdeen; Dr. B. S. Platt, in charge of investigations into nutrition in the Colonial Empire under the Medical Research Council; J. R. Norman, deputy keeper, Department of Zoology, British Museum (Natural History); Dr. C. F. A. Pantin, reader in invertebrate zoology, University of Cambridge; R. S. Wimpenny, naturalist, Ministry of Agriculture and Fisheries; J. Thomson, chief inspector of fisheries, Ministry of Agriculture and Fisheries; Morley Neale, member of the firm of Neale and West, steam trawler owners, Cardiff; C. N. Hooper, clerk of the Fishmongers Company, and R. H. Burt, Colonial Office, *secretary.*

DISCUSSION

THE COLLEGE CURRICULUM IN WARTIME AND INTRODUCTORY COURSES IN BIOLOGY

REPORT Number 15, on "Adjustment of the College Curriculum to Wartime Conditions and Needs," recently issued by the U. S. Office of Education, is to me a most disturbing and puzzling document. Although the Office of Education assumes no responsibility for the statements in the report, attributing them to the committee named in it, publication by this agency will, obviously, give the report a stamp of authority to which it is not entitled. Furthermore, it is hard for me to believe that all the statements in the report have the unanimous endorsement of the committee.

The committee concluded, quite wisely it will seem to most biologists, that it should "not recommend wartime modifications as such in the beginning college courses" (in the biological sciences). Wartime modifications actually have been made by some of us in con-

formity with a fixed course of study, *e.g.*, the Navy V-12, but this has been done temporarily, and in spite of a conviction that the new curriculum may be less satisfactory for the student than the one replaced. The bulk of the report does not deal with this matter, however, which was within its province, but rather with a presentation of positive views on a controversial matter which the committee does not succeed in relating to wartime as contrasted with peacetime conditions.

The principal conclusion of the committee is that courses in general biology are not satisfactory for beginning students. Separate courses in botany and zoology are recommended, the committee concluding that either one alone is better than general biology. The report fails to recognize the fact that general biology is actually successfully taught in a number of institutions among the best academically in this country. The report does not mention any of the inherent advantages that a general biology course has over separate courses in botany and zoology. It appears to me, in fact, that the committee prejudged the issue; the point of view of general biology is as completely ignored in the report as if it were non-existent. Furthermore, the report is worded in such a way that the committee's disapproval of general biology courses appears by insinuation even in those statements not directly expressing an evaluation. This is illustrated in the quotations from the report which follow.

The gist of the committee's finding is to the effect that: "There is no objective evidence available to the Committee to show that general biology (beginning courses) is as good or has any advantage over well-organized courses of general botany or of general zoology. There is subjective evidence and some objective evidence that general botany and general zoology have greater value to the students than the general biology covering the two great fields." The report defines various kinds of general biology courses in such a way that botany and zoology courses are certain to gain by comparison. The implication of the report is that botany and zoology are independent sciences ("great fields"), and that biology is not a great field of science but merely the result of an addition of piecemeal segments of these. It would be interesting to compare the categories distinguished in this report with lists prepared by other committees with quite different points of view; we would probably find little evidence for objective validity in the classification, and probably none for some of the details of the definitions. In any case, if all the categories here given are to be called general biology in a formal report the name might better be enclosed in quotation marks. It is true that many types of courses go by this name and that many of them are not general biology; it is not equally true, however, that they are all unsatisfactory.

According to the report:

> . . . the courses in general biology are constructed as follows:
>
> 1. Introductory zoology (often quite limited in scope and without field work).
>
> 2. Seventy to ninety per cent. zoology with a small amount of botany, and usually taught by men and women trained in zoology. Entomology and fundamental physiology are often omitted.
>
> 3. Courses with about half animal and half plant illustrations but without sequential arrangement that leads to good understanding of either plants or animals or to the applications of the studies. Usually taught by zoologists.
>
> 4. A half year of botany followed by a half year of zoology with the zoology using the previous training in botany as the starting point for the second semester's work; this organized as a sequential whole and the botany and zoology taught by men well trained in botany and zoology.

A much more objective and more complete estimate of the weaknesses of general biology courses was made by Professor George E. Nichols.[1] His paper is very valuable as a guide to the difficulties of conducting courses in general biology.

Note under the third category above the statement "usually taught by zoologists"; that was the favorite criticism of certain botanists of a generation ago, biology having been referred to as "botany taught by a zoologist." The statement does not suggest that there is such an individual as a person with a broad biological point of view, but rather that biologists are all, of necessity, either botanists or zoologists. Elsewhere the report implies that an individual well trained in both botany and zoology is indeed rare. That individuals sufficiently well trained to direct advanced work in both botany and zoology are rare may be true, but that those trained for the purpose here implied are rare, I doubt. Certainly, considering the number of individuals who are quite competent in both a physical and a biological science, there is no inherent reason for such narrowness.

I am unable to understand what is meant by the phrase in the description of category three "without sequential arrangement." A taxonomic arrangement is implied under number four, and this seems desirable to the committee. A taxonomic approach in general biology, however, is quite unsound as well as wasteful of time; but a logical arrangement of another kind is quite essential. In general biology, plant and animal materials are considered in relation to metabolism, behavior, reproduction and development, heredity, evolution and distribution, not primarily in relation to morphological patterns. The fundamental con-

[1] SCIENCE, 50: 509–517, 1919.

cepts of biology are better taught thus. That is why exponents of a well-organized general biology course believe that it has advantages over separate courses in botany and zoology ("well-organized" or not), or over a combination of the two if there is not more integration than is usually attempted. The fourth category is not general biology at all, but a short course corresponding to the committee's recommendation. The committee has not recognized in practise what it does admit in theory, *viz.*, "that the same fundamental laws of life apply generally to all organisms." It is unfortunately true that most text-book writers have failed to produce a text-book built upon this underlying concept. Such writers are still bound by tradition and circumstance, most so-called general biology text-books being poorly integrated accumulations of botanical and zoological facts. One text that stands out as an example of what should be done on a wider scale (Plunkett's "Outlines of Modern Biology") remains one of the most widely praised but least used of the group.

Much of the force of the report lies in its reiteration of its central theme. This occurs again in Part II of the committee's report, worded, however, even more positively than before: "If there is objective evidence or sound subjective evidence that general biology courses have lasting value for the students, it has not been made available to this committee." I do not know what would constitute "sound subjective evidence"; I only know that I would hesitate to question the existence of evidence, objective or subjective, for the lasting value of any course for any students. Surely, some of the thousands of non-science students who listened to Professor Conklin's lectures in general biology at Princeton, but who went no further in biology, derived some lasting benefit. The record has been similar in other American colleges and universities, Stanford, Chicago, Yale, New York University, to name a few. I for one refuse to admit that this concept of a science of biology, introduced to America by an eminent Englishman nearly seventy years ago, should now be abandoned in the organization of introductory courses in biological science. We need more, rather than fewer, introductory courses in which there may emerge in the student's mind a concept of a unified science of life.

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A POISONOUS PEA CONTAMINATE

THE synonym "nightshade" is applied to the various species of the genus *Solanum*. Black nightshade, *S. nigrum* L., is one of the most cosmopolitan of the wild plants, extending over the entire globe. Yellow nightshade, *S. nigrum* var. *villosum* L., *S. villosum* Lam. or *S. luteum* Mill., has been found in Europe but grows mostly in the United States. Cut-leaved or three-flowered nightshade, *S. triflorum* Nutt., is a native of the Great Plains and Rocky Mountain region of the United States. All three of these nightshades are found in the Inland Empire, a section covering eastern Washington, northern Idaho and extreme northeastern Oregon.

Nightshades have become of late a serious problem to the pea industry. Many canneries have had difficulty in separating the nightshade berries from the peas. Both mature at the same time and are approximately the same size. The Food and Drug Administration prohibits the sale of peas which are adulterated with nightshade berries. This act has been questioned, because some do not consider the berries toxic but actually look upon them as a food. Doubt as to the toxicity of the yellow and three-flowered nightshades is justified considering that very little or no scientific data have been published on this point. The black nightshade was shown to contain a poisonous substance, solanine, first by Desfosses in 1821. Ecological factors cause a great variation in solanine content of all plants containing it. No quantitative data have been published on the solanine content of these plants found growing in the Inland Empire.

Work in the laboratories of the School of Pharmacy, State College of Washington, which is in progress, has reached the point where the toxicity of *Solanum triflorum* can be definitely stated. Solanidine has been indicated by qualitative test in *S. nigrum* var. *villosum* and has been isolated from the fruit of *S. triflorum*. This indicates that these species of *Solanum* are toxic, but the data concerning the amount of the toxic substance present will have to wait until work in progress has been completed.

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MERCURY IN DRAIN PIPES

RECENTLY we had occasion to clean out the drain pipe of one of our laboratory sinks and found, among other things, about a quarter of a pound of mercury trapped in the drain elbow. This quantity probably represents several years' accumulation. I recollect having similar experiences in the past and suspect a similar condition exists in the drains of most of the scientific laboratories in the nation. Might I suggest the exploration of this possibility as a means of adding a significant quantity of this vital metal to our nation's stores?

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SCIENTIFIC BOOKS

APPLIED MATHEMATICS

Quarterly of Applied Mathematics. Under the sponsorship of Brown University. Vol. I. Number 1, April, 1943. Number 2, July, 1943.

THE first scientific journal entirely devoted to applied mathematics, *i.e.,* to the applications of mathematics in other branches of science and to the development of mathematical methods suited for this purpose, was founded in Germany in 1921. It has been known as the *ZAMM* (*Zeitschrift für angewandte Mathematik und Mechanik*) and was published by the Verein Deutscher Ingenieure, the German Engineering Society. This enterprise was an outcome of the long-continued efforts of Felix Klein, the famous mathematician of great productive power who devoted a considerable part of his lifetime to the task of placing the cultivation of mathematics in Germany on a sounder basis. For some historical reasons, in Germany, unlike other countries, engineering sciences had never been admitted to the universities, but were taught at strictly separate institutes of technology. The mathematicians teaching at the university were in permanent contact with physicists, chemists, etc., but almost entirely unfamiliar with engineering problems, which more and more required the application of advanced mathematical theories, as had been the case in physics for a longer period. Under the influence of Felix Klein chairs of "applied mathematics" were created at several universities, and the *ZAMM* was intended to serve as a further bridge between the university people and those interested in engineering research at the Technische Hochschulen. This explains the somewhat illogical conception of "Angewandte Mathematik und Mechanik," which emphasizes mechanics and practically excludes physics, although physics is obviously the principal and most important field of application of mathematical ideas.

The pattern set by the *ZAMM* was then followed in several other countries. In Russia, where the educational institutions are similar to those in Germany, a journal was founded in 1933 under the same title. It was later taken over by the Russian Academy of Science and is to-day by far the best periodical in this field, assembling papers of high originality and intrinsic value. In the same year a group of members of the American Society of Mechanical Engineers started the *Journal of Applied Mechanics,* which actually covers the major part of the subjects dealt with in the *ZAMM*. Two other American magazines concerned with special branches of applied mathematics must be mentioned here. In 1933, likewise, the Institute of the Aeronautical Sciences began publication of a scientific journal, which under the able leadership of J. C. Hunsaker developed into one of the foremost aeronautical publications covering all problems of fluid mechanics, dynamics and stress analysis connected with aviation. Three years earlier the Institute of Mathematical Statistics had started publishing its *Annals,* a high-ranking magazine devoted to research papers in probability and theoretical statistics on an advanced level.

Thus the situation regarding publishing facilities in applied mathematics was very different now in this country from what had been the case in Germany twenty-two years ago. First, the sharp contrast between mathematicians and physicists on one side and engineers on the other has never existed in America (nor did it in England). Secondly, care had already been taken, in a rather ample measure, of special branches, particularly of those related to mechanical engineering. Nevertheless, a distinct demand has been widely felt for a new avenue of publication, owing to the peculiar character of the research work as favored at present by American mathematicians. Except for a few outstanding men of the older generation, like Birkhoff and Veblen, the mathematicians here are almost exclusively concerned with the most abstract parts of mathematics. No geometry but topology, no analysis but theory of sets, no algebra but abstract algebras are the largely preferred subjects at meetings and in the magazines. Classical mathematics which developed for centuries in close relationship to physics are treated with a kind of disdain. In this way a new gap has been created, with the mathematicians on one side as opposed to all the people who apply mathematics, in physics and chemistry, in engineering, in statistics and economy, in biology, etc. What is needed to counterbalance this unfortunate state of affairs are efforts in a definite direction—one has to concentrate on the general aspects of applied mathematics without emphasizing any particular branch or subject, and in doing so to feel responsible for the advancement of all parts of classical mathematics, so badly neglected by the "pure" mathematicians.

It does not make the impression that the group at Brown which undertook to start the *Quarterly of Applied Mathematics* has chosen to follow this line. It seems that what they had in mind was not unlike another *ZAMM,* with a more restricted program. On the inside cover the editors simply ask for papers "which have an intimate connection with application in industry or practical science," and the whole program is focused on "tooling up mathematics for engineering." Papers on probability, statistics, economy, biology seem practically excluded. Theoretical physics and chemistry, the paramount fields of application, are not mentioned. In the board of editors, which includes Th. von Kármán, leading man in aeronautical

research, none of the country's representative mathematicians is listed. In the first two issues at least 90 per cent. of all articles are concerned with problems of mechanical engineering, and most of them could have been published in either *Applied Mechanics* or *Aeronautical Sciences*. There is of course no objection against duplicating existing facilities as long as care is taken not to lower the existing level. But it is one thing to grow a new variety in order to adorn one's own garden and another thing to fill a widely felt need and to serve a far-reaching purpose of common interest. Now it may take a long time before such a journal as had been hoped for will materialize.

Each one of the first two issues includes an expository article, both of high value. H. L. Dryden reports on the modern theory of turbulence, and it is very interesting to realize the progress made since, ten years ago, the *Journal of Applied Mechanics* started its first issue with a review on the same subject. In the second issue K. O. Friedrichs and J. J. Stoker outline some aspects of non-linear mechanics in a particularly comprehensible form. The most interesting contribution so far is undoubtedly the paper of L. Bers and A. Gelbart, on certain differential equations in mechanics. It has been known for a century that the problem of finding the two-dimensional potential flow of an incompressible fluid can be solved by means of complex variables: To each analytic function of a complex variable corresponds a particular solution of the potential problem and *vice versa*. Several years ago Stefan Bergman discovered that essentially the same is true for a vast class of partial differential equations which includes the potential equation as the simplest case. Bergman gave explicit formulae which allow a solution of a given differential equation to derive from an arbitrarily chosen analytic function (in some instances from a pair of real functions) and proved that all solutions can be derived in this way. Now, two of Bergman's pupils, Bers and Gelbart, found that in a special case the analogy can be carried much farther. They consider a special type of differential equation, yet more general than the potential equation, and build up a system of solutions in close analogy to the procedure followed in the theory of analytic functions. Fortunately, this restricted type includes the problem of a two-dimensional flow of a compressible fluid which is to-day in the center of interest in aviation. Though all solutions obtained by Bers and Gelbart can be derived by Bergman's methods also, it must be expected that the new approach will prove very useful.

The quality of papers in a magazine can not possibly maintain a uniformly high level and a large allowance must be made for unavoidable deficiencies. In the second issue a kind of mischief happened with an article on the flow around an airfoil with flap. The author tries to compute the point on the flap where the flow separates, forming a dead-air region. But he overlooked that according to the very formula he applies the flow must have already separated at the corner before reaching the flap at all. If the corner is rounded-off, the separation point will travel along the flap and its position will be determined by the radius of curvature so that the proposed solution, also in this case, gives no answer to the real problem.

Such an accident must not be taken too seriously and by no means blamed on the editors. On the contrary, it is the opinion of this reviewer that many editors feel too often inclined to act like schoolmasters examining the papers submitted for publication as though they knew all answers beforehand. This teacher-to-pupil relation takes a particular form in the *Quarterly*, where a large number of articles are marked as "suggested" or "encouraged" or "directed" by an editor. That more of this must be expected can be concluded from an article in the *Mathematical Monthly*[1] in which Dean R. G. D. Richardson, of Brown University, illustrates the background of the new magazine. The author proudly reveals that "more than twenty-five research papers have been completed" within a short period in the School of Advanced Mechanics at Brown. It seems that here the borderline between research work and the type of results which usually grow out of the problem sections in a graduate school is somewhat misplaced. In fact, nothing would be more detrimental for the development of applied mathematics as a genuine branch of science than to propagate the idea that in this field papers can be turned out to order. History has taught that the best, if not the only, way to promote scientific achievements is to leave people who are able to do creative work to themselves and to protect them as far as possible against all kinds of organizers and inciters.

All this criticism should not discourage a reader who wants to be currently informed about certain aspects in the progress of engineering mathematics. He will certainly find much useful and interesting material in good shape. Nor is the criticism meant to underrate the merits of the men who have spent considerable time and labor to create the new periodical and to keep it going. After all, there are many roads that lead to the same goal and nobody knows which is the best. Brown University has undoubtedly made great sacrifices in bringing forth the journal at the present time and under actual difficulties. The format is irreproachable. If wisely conducted, the *Quarterly of Applied Mathematics* will achieve a notable place among the other American publications in this field.

RICHARD VON MISES

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[1] *Math. Monthly*, Vol. 50, p. 415, 1943.

SPECIAL ARTICLES

MAMMARY CANCER AND MAMMARY STRUCTURE IN INBRED STOCKS OF MICE AND THEIR HYBRIDS[1, 2]

GARDNER and Strong[3] used the whole mount technique to study the structure of the mammary glands in virgin females of several stocks of mice, including the A and C3H strains, and could not detect any difference in the architecture. Also, the inherited tendency for spontaneous mammary cancer was not found to be associated with any change in the structure of the glands. In a later publication, Gardner, Strong and Smith[4] observed the presence of localized hyperplastic nodules in glands of animals from strains in which mammary cancer frequently resulted. Few, if any, of the nodules were found in the glands of mice from low cancerous stocks.

Taylor and Waltman[5] stated that the essential difference in the structure of the glands from mice of the cancerous dilute brown stock and low cancerous C57 black strains was in the number of acini (hyperplastic nodules) found in glands of mice of the cancerous strain. This difference persisted following the injection of estrogenic hormones. Using the same strains, van Gulik and Korteweg[6] concluded that in virgin females an architectural difference in the structure of the primary ducts and the gland-trees could be found. The F_1 hybrids, produced by reciprocal matings, had glands whose primary ducts were characteristic of the maternal strain, while the gland-trees resembled the maternal type but were modified in the direction of the type found in the paternal strain. They believed the hyperplastic nodules to be associated with the active milk agent.

Loeb and Suntzeff[7] stated that one of the factors determining the difference between mice of various strains toward the development of mammary cancer was the readiness with which the glands gave progressive growth to stimulation by estrogens.

MATERIAL AND METHOD

To determine what the incidence of mammary cancer might be in hybrids, reciprocal matings were made between mice of the cancerous A and C3H stocks. The hybrids have been maintained either as virgin or breeding females, but only the former are considered in this report. In addition to the incidence of mammary cancer, the architecture of the mammary glands was studied by the whole mount technique.

Virgin females of the A stock have a low incidence of spontaneous mammary cancer,[8] whereas non-breeding females of the subline of the C3H or Z stock used in these experiments frequently develop such tumors.[9] Breeding females of each strain have a high incidence of mammary tumors.[10]

The oldest animals have attained the age of 14 months, but because the youngest mouse to become cancerous did so at approximately 9 months of age, only mice which have reached that age will be mentioned.

The animals are receiving Purina Fox Chow and an unlimited amount of water.

RESULTS

In previous experiments, virgin females of the A stock had an incidence of mammary tumors of 4.9 per cent.,[11] whereas virgin females of the C3H or Z stock gave an incidence of 72 per cent.[9] (and unpublished). The number of mice observed was 223 and 51, respectively.

The number of mice being observed at present is given in Table 1, together with the number in each group living to be 9 months or older. The incidence of mammary cancer was determined from the number of mice which had survived for at least 9 months. To date, few animals have died without cancer.

TABLE 1

Stock	Number under observation	Number surviving for 9 months or longer	Cancer incidence for virgins living 9 months or longer
A	101	55	0 per cent.
Z or C3H	104	7	43 " "
AZF_1	121	47	45 " "
ZAF_1	65	10	20 " "

AZF_1 hybrids were produced by mating females of the A stock with males of the Z or C3H strain; the ZAF_1 hybrids were derived from the reciprocal cross. From Table 1 it will be seen that mammary tumors are being recorded in virgin females of the Z or C3H stocks and their reciprocal hybrids; to date none of the virgin females of the A stock has had tumors. (Our earlier studies showed an incidence of 27 per cent.[9] spontaneous mammary tumors in C3H virgins at 9 months.)

The mammary glands of mice from the inbred stocks

[1] Preliminary report.

[2] Assisted by the University of Minnesota Graduate School Cancer Research Fund and The Jane Coffin Childs Memorial Fund for Medical Research.

[3] W. U. Gardner and L. C. Strong, *Am. Jour. Cancer*, 25: 282–290, 1935.

[4] W. U. Gardner, L. C. Strong and G. M. Smith, *Am. Jour. Cancer*, 37: 510–517, 1939.

[5] H. C. Taylor, Jr., and C. A. Waltman, *Arch. Surg.*, 40: 733–820, 1940.

[6] P. J. van Gulik and R. Korteweg, *Proc. Nederl. Akad. van Weterschappen*, 43: 891–900, 1940.

[7] L. Loeb and V. Suntzeff, *Arch. Path.*, 32: 739–759, 1941.

[8] J. J. Bittner, *Pub. Health Rept.*, 54: 380–392, 1939.

[9] M. B. Visscher, Z. B. Ball, R. H. Barnes and I. Sivertsen, *Surgery*, 11: 48–55, 1942.

[10] J. J. Bittner, *Cancer Research*, 2: 710–721, 1942.

[11] J. J. Bittner, *Pub. Health Rept.*, 54: 1113–1118, 1939.

and their hybrids have shown minor variations in their architecture when studied by the whole mount technique. These findings will be presented in another report when more data are available.

Hyperplastic ("precancerous") nodules were found in the glands of virgin females of the C3H stock and the AZF_1 and ZAF_1 hybrids which had reached the age when mammary cancer might be expected to develop. The nodules were more numerous in the glands of the hybrid mice than from the C3H animals. They were also found in the glands of mice of these groups which had not developed cancer but had survived to the cancerous age.

The glands from a few virgin females of the A stock of the same age did not have any hyperplastic nodules.

In addition to the virgin females, the glands of fostered breeding females of the A and C3H stocks were examined. All the females had given birth to at least 3 litters and ranged in age from 11 to 16 months. Only occasionally a nodule was found and never more than one to a gland.

Discussion

Spontaneous mammary cancer in mice will develop only in glands which have been stimulated to growth by estrogenic hormones. Although the virgin females of the A stock develop very few mammary tumors,[8] their mammary glands appear to be as well developed —except for the absence of hyperplastic nodules—as are the glands of the virgin females of the C3H stock in which mammary tumors frequently are found.[9]

The differences producing these incidences of cancer between virgin females of the A and C3H stocks appear to be explicable most satisfactorily on the supposition that they are due to characteristic differences in hormonal metabolism, in a broad sense, in mice of the two strains. This deduction finds its strongest support in the fact that repeated pregnancies in females of the A strain brings the incidence of mammary cancer in the latter to that in the C3H mice.[10,12] If this supposition is correct it would be deduced that a difference in the virgin state in (a) the amounts of estrogen produced or available for action on the mammary glands, or (b) the sensitivity of those structures to estrogens, or a combination of both, would be responsible for the strain difference observed.[11] Whatever the cause (or causes) may be, these data suggest that the effect is controlled by intrinsic factors since the first generation hybrids with C3H fathers and mothers from the A stock have developed spontaneous mammary tumors when maintained as virgin females. It can further be inferred that this characteristic difference in the production of mammary tumors in virgin females of the A and C3H stocks is inherited as a dominant character.

The entire problem of the nature of "inherited susceptibility" is brought to the fore by these observations. It is not possible to analyze all the factors involved in detail at this time, but the observations reported indicate that at least one physiological character determined genetically operates through a hormonal mechanism. It is doubtful whether this inherited hormonal character corresponds completely with the "inherited susceptibility for spontaneous mammary tumors"[13] as previously described.

No correlation could be detected between the presence of the hyperplastic nodules or precancerous lesions and the active milk agent alone. The virgin females of the A stock have this influence and nodules were not found in the small number of glands which were examined. However, the nodules were found in virgin females which had the active milk agent and the inherited estrogenic factor, as the virgin C3H females and of the reciprocal hybrid generations. That the nodules usually do not result from the estrogenic stimulus alone was suggested by the small number of them found in the glands of fostered breeding females of the A and C3H stocks. These mice did not have the milk agent, but the estrogenic influence would be greater, because of the production of young, than one would expect in virgin females. In these mice the inherited estrogenic stimulus would be supplemented by the extrinsic (breeding) stimulus. The fostered breeding females of these stocks have a low incidence of mammary cancer.[10]

Thus, the tentative theory may be advanced that the hyperplastic nodules result from the inciting influence of both the active milk agent and the estrogenic hormones[14] and not solely from the action of the milk agent, as suggested by van Gulik and Korteweg.[6]

Conclusions

Characteristic differences in hormonal metabolism in virgin females of inbred strains of mice may result from: (a), the amounts of estrogen produced or available for the stimulation of the mammary glands, and/or (b), the sensitivity of the mammary glands to estrogenic hormones.

The inherited estrogenic influence is transmitted as a dominant and plays a role in the genesis of spontaneous mammary tumors in virgin females of inbred strains and their hybrids.

The inherited estrogenic influence is probably not identical with the "inherited susceptibility for spontaneous mammary cancer."

Hyperplastic or precancerous nodules in the mam-

[12] J. J. Bittner, *Cancer Research*, 3: 441–447, 1943.

[13] Females of the A stock transmit the inherited susceptibility for spontaneous mammary tumors to their hybrids, but tumors do not result unless the females are used as breeders; unless an extrinsic source of esterogens is obtained.[11]

[14] Nodules have been found in breeding females of the non-susceptible C57 black stock which had received the active milk agent by foster nursing.

mary glands of mice probably result from the inciting influence of the mammary tumor milk agent and the estrogenic hormones.

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AEROSOL, A NEW METHOD OF APPLYING GROWTH REGULATORS TO PLANTS[1]

L. D. GOODHUE[2] found the aerosol method to be an excellent and efficient one for dispersing certain insecticides. One method of producing aerosol involves the use of a highly volatile liquid carrier in which the insecticide is dissolved either directly or after it has been dissolved in some other solvent. The solution of carrier, solvent and insecticide is contained under pressure in a suitable receptacle from which it can be released as a mist. The carrier immediately volatilizes, leaving the insecticide suspended in the air in an exceedingly finely divided liquid or solid state. This method of applying insecticides suggests a new means of applying growth substances to plants for the purpose of modifying development, such as delaying opening of buds, preventing abscission of flowers and fruit and aiding fruit setting. Preliminary results indicate that the method may prove of much value for such applications.

An experiment was designed to determine the effectiveness of a growth substance in setting seedless fruit on tomatoes, when dispersed as an aerosol form. For this purpose three grams of naphthoxyacetic acid were dissolved in 27 grams of cyclohexanone. This solution was placed in a steel cylinder into which 270 grams of di-methyl ether was then forced under pressure.

Ninety-six Pan America tomato plants were grown under greenhouse conditions until the first blossoms of the first cluster had opened. One half of the plants were kept in the greenhouse as controls and the remainder were held for 16 hours in an air-tight room into which aerosol containing naphthoxyacetic acid was released. The naphthoxyacetic acid was dispersed at 240 mg per 1,000 cubic feet. The plants were then taken back to the greenhouse and allowed to grow under the same conditions as the control plants. Three days later fruit enlargement was observed upon the treated plants and none upon the controls. Nine days after treatment the average number of fruit set per plant for the first cluster was 3 for the treated plants and 0.5 for the controls. The average diameter of fruits after 36 days was 2.9 inches for the treated plants and 2.1 for the controls. Ten fruits collected at random from the treated plants were all seedless.

Thirty-two additional tomato plants treated in the open air have also set fruit. In this experiment the cylinder was held at a distance of one foot from the plant and the valve was opened for about one second. The mist covered the flower cluster but was quickly carried away from it by air currents. The plants were then returned to the greenhouse. The number of fruits set per plant in the treated lot was comparable to that obtained in the first experiment. The controls in this instance failed to set fruit.

Further studies are under way to test field applicability of this method and to test various other growth substances. Tests will also be made to determine quality of the fruit developed.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SPRING-PRESSURE-CONTACT ELECTRODE FOR USE IN ELECTRO-ENCEPHALOGRAPHIC RECORDING[1]

WITH the widespread use of the electroencephalograph to survey large populations in both military and civilian medicine and with an increased difficulty in obtaining technicians for this work, it has seemed necessary to devise a fast, simple technique of electrode application.

Since Berger reported the recording of electrical potentials from the human brain by means of silver wires inserted into the anesthetized scalp, electroencephalographers have sought more efficient ways of electrode application.[2, 3, 4, 5, 6, 7, 8] Concerning the

[1] C. L. Hamner, assistant physiologist, and H. A. Schomer, associate physiologist, Bureau of Plant Industry, Soils and Agricultural Engineering, and L. D. Goodhue, senior chemist, Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, U. S. Department of Agriculture, Beltsville, Md.

[2] L. D. Goodhue, *Ind. and Eng. Chem.*, 34: 1456–1459, December, 1942.

[1] From the Department of Anatomy, University of Oregon Medical School. The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and the University of Oregon Medical School.

method at present most commonly used, namely, the application of small solder pellets to the scalp with collodion, it has been stated that "No one should consider himself trained in this procedure, until he has applied at least three hundred electrodes."[5] It has been our experience that this is a conservative estimate and that the training of new technicians, together with the length of time required for electrode application and the artifacts caused by the loosening

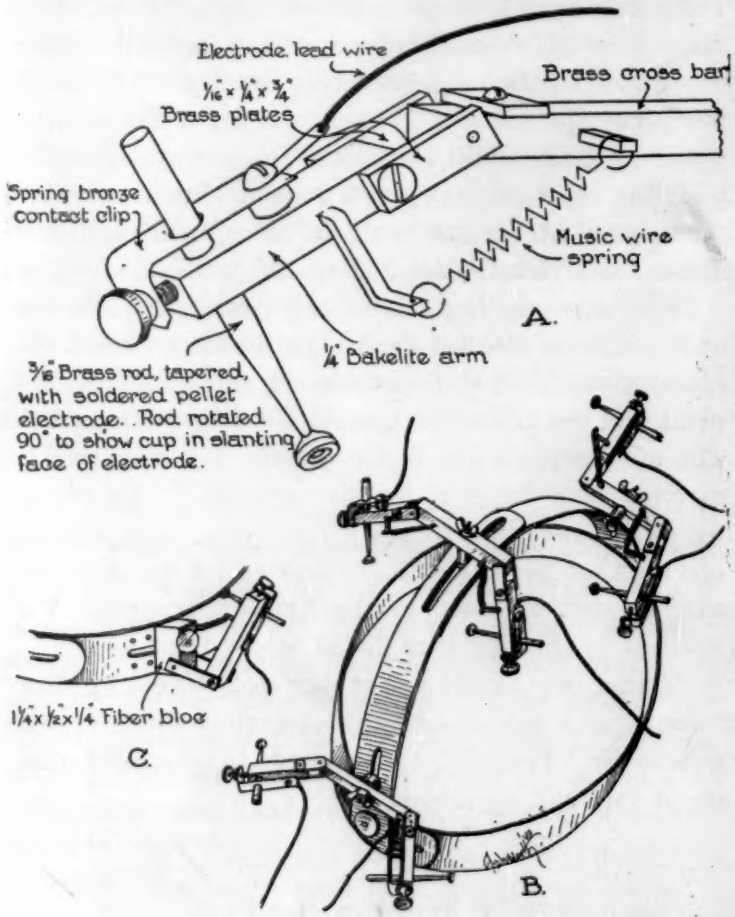

FIG. 1

of such electrodes when improperly applied, make this method quite unsatisfactory.

Hence a method of spring-pressure-contact electrode placement was developed which has, in our hands: (1) substantially lessened the time required for electrode application; (2) obviated the necessity for long practice in electrode application; (3) dispensed with the collodion so often objectionable to the patient, and (4) aided in the comparison of EEG records from patient to patient by permitting a more uniform electrode placement.

Fig. 1a shows one of the electrode assemblies. The electrodes are short sections of brass rod tipped by shallow solder cups. They are freely adjustable, yet held firmly in place by a set-screw as they pass through holes in the bakelite arm and spring bronze contact clip. The continuity of the electrical circuit is maintained by pressure of the spring bronze clip against the set screw. The bakelite arm is hinged to the cross bar (Fig. 1a) or other holder (Fig. 1c), by means of a pin through two small brass plates. The tension of a 0.013-inch piano-wire spring holds the electrode in the "up" position when not in use (Fig. 1b) and furnishes tension for keeping it against the scalp when recording is in progress. Thick electrode paste is placed on the tip of the electrode and rubbed into the scalp prior to making contact.

A fiber headband with adjustable members can be cut from a 1/16-inch fiber sheet or obtained from an electric arc welder's supply house in the form used for supporting a welder's hood. Bolts fastened through slits cut in the top and side of the band allow for free movement of the electrodes in an antero-posterior direction. In the routine 6 electrode holder (Fig. 1b) three cross bars of convenient lengths hold pairs of symmetrically placed electrodes which are movable over the frontal, parietal and occipital regions of the scalp. In a 16 electrode holder (useful for localization of intracranial lesions), five of these movable cross bars on the center band are supplemented by six individually mounted single electrodes, which, as shown (Fig. 1c), are movable along the sides of the headband and permit recording from lateral regions of the head.

Records are most conveniently taken with the patient in a sitting position. Recording in the supine position is possible with the use of a block pillow placed beneath the neck and base of the occiput.[9]

GEORGE A. ULETT
FRED B. CLAUSSEN

[9] The authors wish to express their thanks for helpful criticism and suggestions from Dr. Robert S. Dow and Dr. Knox Finley, of the University of Oregon Medical School.

[2] H. L. Andrews, *Am. Heart Jour.*, 17: 599–601, 1939.
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SCIENCE NEWS

Science Service, Washington, D. C.

TITAN

THAT the atmosphere of the planet Saturn's largest satellite, Titan, consists of methane or marsh gas and possibly of ammonia has been discovered by Professor G. P. Kuiper, of the McDonald Observatory of the Universities of Chicago and Texas, as a result of successfully photographing its spectra. The Titan thus becomes the only moon in the solar system known to have an observable atmosphere.

This information is being transmitted by the Harvard clearing house to astronomers all over the world, as it has an important bearing on problems concerning the atmospheres of all planets and their moons as well as on the origin of the solar system.

Several decades ago, observations indicated that Titan, which is larger than the earth's moon in both size and mass, had an atmosphere, but the difficulty of getting satisfactory spectra prevented study of the constitution of such an atmosphere, if it really existed.

Now Dr. Kuiper's observations prove the existence of the atmosphere and show that it must have abundant quantities of methane, which is usually called marsh gas and is composed of one atom of carbon combined with four of hydrogen. Its atomic weight is about 16, while that of ammonia, composed of one molecule of nitrogen and three of hydrogen, is about 17. It is the relative heaviness of the atoms of these gases, when compared with hydrogen and helium, which enable them to cling to a moon of rather small surface gravity.

Of great significance to astronomers is the fact that Titan's atmosphere appears to be similar to that of Saturn itself. This may indicate a common origin for the two bodies and also a similar constitution. However, Titan has a density about three and a half times that of water, whereas Saturn itself is lighter than water, the only planet for which that is true. Saturn's low density is explained by assuming it to be composed largely of hydrogen. Atmospheres of methane and ammonia for both Jupiter and Saturn add to the evidence supporting this belief, and the finding of an atmosphere containing large amounts of hydrogen around Titan is further evidence along the same lines.—CHARLES A. FEDERER, JR.

INDIANS OF THE MISSISSIPPI VALLEY AND THE EAST COAST OF MEXICO

THAT early Indians of the lower Mississippi Valley may have had direct connections with Indians on the east coast of Mexico, was stated by Dr. William Duncan Strong, director of the Ethnographic Board of Smithsonian Institution, in an address before the Washington Academy of Sciences.

Pottery unearthed in both areas, in excavations directed by Dr. Gordon Eckholm, of the American Museum of Natural History, is decorated with similar patterns of broad, grooved, incised lines. However, Dr. Strong pointed out, as the pottery found in Mexico dates back approximately to 300 A.D. and that found in the United States is placed at approximately 1000 A.D., it indicates an 800-mile, 700-year migration of the Indians from Tampico, Mexico, to Louisiana. Most of the other significant Mexican evidence of this relationship has long since decayed in the humid Mexican climate.

The oldest Indian culture yet unearthed in Chile and the coast of Peru—a simple fishing population which preceded the agricultural and horticultural civilizations—was also described by Dr. Strong. Fishhooks, bowls cut from lava, barbed harpoons with stone points finely flaked by pressure, and coarse percussion-flaked stone tools made by banging one stone against another to rough-shape the instrument, remain to tell of the customs of this prehistoric people. Junius Bird, of the American Museum of Natural History, with Dr. Strong, brought this evidence to light in the course of a year of intensive excavation.

"The great vistas in time and space revealed by the present program of intensive research and excavations make it abundantly clear that the field of Middle and South American archeology is rapidly ripening, with a promise of rich scientific harvest. It has always been a field of superlative prehistoric interest, but only recently has scientific work been envisaged on sufficiently broad and clean-cut lines to give definite promise of more sweeping and valid culture-historical results," Dr. Strong predicted. "There seems little doubt that when the blight of the present war is removed this type of research work will surge forward in all the American republics."

DISCOVERY OF A METEORITE

A FOUR-POUND meteorite has been discovered quite by accident in a farmhouse yard in the northern part of Cowley County, Kansas. While serving as field representative for an oil company, H. H. Nininger, of the American Meteorite Laboratory, found the stony specimen.

"While pumping a drink, I was, as always, scanning the premises for odd-looking stones," Mr. Nininger reports in the current issue of *Popular Astronomy*. "Under some plum bushes a few steps away I noticed a rusty-looking chunk of rock about the size of my two fists and at once decided that it needed investigation. I stepped over and picked up the rock, which was evidently a badly weathered stony meteorite (an aerolite)."

Students of meteorites seldom have the good fortune to stumble upon a meteorite in the field. This specimen represents a completely new find. No other meteorite has been reported from any point nearer than 50 miles, and the stone is recognized as belonging to a different fall from those.

Meteorites are classified roughly as stone and iron. Iron specimens are more numerous in museums because they are more easily identified. Many more stones than irons, however, have been seen to fall.

A GIANT-GRAINED HYBRID WHEAT

A GIANT-GRAINED hybrid wheat, with individual kernels almost three times the weight of ordinary wheat grains,

is one of the agricultural novelties which Soviet scientists are preparing to carry back into western Russia as soon as it has been cleared of Nazis. A cablegram received here from the Soviet Scientists' Anti-Fascist Committee in Moscow adds that the new grain variety is also highly resistant to practically all known fungus diseases of wheat.

The hybrid was orginated by Academician Anton Zhebrak, member of the Belorussian Academy of Sciences and professor of genetics at the Timiriazev Academy. He was working on his breeding experiments in the White Russian city of Minsk when Hitler's invasion was launched, and carried his priceless propagation stock with him as he left the burning streets behind. Now he is ready to carry the descendants of those grains home from exile, for further tests in their ancestral soil.

Academician Zhebrak's hybrid is a cross between the standard hard or macaroni wheat known botanically as Triticum durum and a recently discovered wheat species from the Caucasian highlands, called Triticum timopheevi. He has patriotically given it the name Soviet wheat, or Triticum sovieticum.

t is from the timopheevi wheat that the new hybrid parently derives its extreme resistance to fungus attacks. The same species has been introduced into breeding practice in the United States; of no economic value by itself, it is prized for the contributions it makes in hybrid combinations.

Academician Zhebrak has also produced a hybrid between the timopheevi species and common wheat (Triticum vulgare), which has progressed to the stage of large-scale field tests.

Both these hybrids are of the type which geneticists call amphiploid. This means that the full number of heredity-bearing chromosomes in the cells of both parents are added together in the offspring, instead of being halved and the half-numbers then added. This increased chromosome number often gives the resulting hybrids considerable advantages such as increased size and greater vigor.

The chromosome number for timopheevi wheat is 28, for durum wheat the number is also 28, and for common wheat it is 42. The timopheevi hybrid with common wheat thus has 70 chromosomes per cell, while the new Soviet wheat has 56.

ITEMS

NOVAE may owe their sudden flash of brilliance to the union of the small dense cores of Cepheid stars, those variables of the heavens which increase and decrease in brightness with clock-like regularity, according to a theory developed by two British astronomers. The two center cores whirl around each other within a large, tenuous atmosphere, which cloaks the cores so that the star does not appear double. The cores get closer and closer together until finally they unite into a single body. At this point some of the stellar material may be thrown out into space in an attempt of the star to restore its stability, is reported by Dr. R. A. Lyttleton and F. Hoyle of the *Monthly Notices* of the Royal Astronomical Society. As the dense center cores unite, the main body of the star may be torn away and the extremely hot surfaces underneath be exposed. The star would therefore shine for a time with much greater brilliance than its real surface temperature warranted. Novae would be just another stage in the development of these Cepheid variable stars, according to the authors, who think it possible for a star to flare up in brightness enough to be called a nova more than once in its lifetime.

HIGH-OCTANE fuels such as are used in aircraft are not suitable for ordinary automobiles. These fuels produce tremendous pressure, and any automobile engine which could be developed to use them effectively would be too expensive, too heavy and too noisy. This is the opinion expressed by C. B. Veal, of the Coordinating Research Council, Inc., New York, at the Detroit meeting of the Society of Automotive Engineers. Even if designers should produce an automobile engine capable of satisfactory operation with high-octane fuels, petroleum refiners would be forced to adopt expensive and uneconomical refining methods, he stated. "Production of these fuels consumes special chemicals at costs prohibitive in peacetime," he added, "and greatly reduces the yield of fuel per barrel of crude oil."

The man with the wrench holds the responsibility for the service life of assembled machine parts, declared J. O. Almen, of the General Motors Corporation at the same meeting. "Just how much he tightens a nut, bolt or stud determines the ultimate working life of the assembly." He is "held to be a factor 16 times more important than design, metallurgy, or processing." "Good design and materials, heat-treatments, and superior manufacturing processes all are desirable," Mr. Almen said, "but the fatigue strength of highly loaded bolts, studs, and nuts finally is determined by the man with the wrench—and how little, or much, he applies that tool in the tightening procedure." Tests show, according to the speaker, that if the initial tension on a bolt is increased from 1,420 pounds to 8,420 pounds, fatigue durability goes up from 5,960 stress cycles to more than 5,000,000. When a nut is tightened against reasonably rigid abutments to produce in the bolt a tension equal to or greater than the working tension load, the speaker stated, practically no stress change takes place and the bolt's operating strength approaches its static strength.

TRADITIONAL hog-scalding to remove the hair in butchering may soon be "out," replaced by a new scientific method. In the new process porkers are plasticized and peeled. The dead hog is submerged in a tank of liquid plastic, then pulled out coated with the sticky stuff. When properly cooled, the plastic is stripped off, taking all the hair with it. The process is quick, clean, thorough and economical. The plastic used is a resin chemical. After being used on one hog it is remelted and used again and again. Bristles, whiskers, stubble and hairs are removed from the liquid before it is re-used. They are just as suitable for commercial uses as if they had been removed by the old scalding-scraping method. The new chemical shaving method, and the resin chemical used, were developed by the Hercules Powder Company.